

CONSOLIDATED INFORMATION TECHNOLOGY SERVICES TASK ASSIGNMENT (TA)

1. **TITLE:** (D104) UAS Surrogate Research Aircraft

TA No:	282	
Task Area Monitor:	Alternate Task Area Monitor:	None
NASA POC:	Software Control Class:	Low Control
Type of Task:	Recurring Task	

2. **BACKGROUND**

There is a current project to demonstrate the possibility of transforming the NASA Langley Cirrus SR22 general aviation aircraft into a UAS systems research vehicle or UAS Surrogate. This UAS Surrogate will have limited control from the ground but also have a Safety Pilot onboard with the capability to override or disable all remote control functions. The Safety Pilot will also make it possible for the UAS Surrogate to fly in the National Airspace System without special Air Traffic Control waivers or clearances.

3. **OBJECTIVE**

The elements of the UAS Surrogate will include Windows PC hosted Flight Software, Ground Station PC software, redundant two-way radio data links, and the capability to send commands to the aircraft autopilot. While different in many respects, the Small Aircraft Transportation System (SATS) High Volume Operations-2 (HVO2) experiment had most of the required elements required for this project. Therefore, it is suggested that the existing HVO2 software be modified for this new task. A phased approach is proposed for this project and additional capability will be added as money and other resources become available. Many of the capabilities and requirements in this document have been produced in existing applications software. Where possible, it is very desirable and encouraged to re-use existing software capabilities.

4. **GENERAL IT SUPPORT SERVICES**

Exceptions and Additional Requirements:

The Contractor shall support on-site and off-site flight test and demonstrations as required during the period of performance.

General IT Support Services Performance Metrics

Performance Standard: Product quality meets customer expectations.

Performance Metrics:

- Exceeds: Product performance exceeds customer's documented requirements and expectations. Product provides service to the customer beyond anticipated use requirements. Customer provides written or verbal communication indicating the same.
- Meets: The product performs as documented in the requirements and meets customer needs. Customer is satisfied with product and uses in the manner intended.
- Fails: Product does not perform as documented in the requirements and customer expectations are not met. Customer is not satisfied with product and cannot use in the manner intended.

Performance Standard: The contractor delivers products (applications, data, etc.) within costs and schedule.

Performance Metrics:

- Exceeds: The contractor delivers products to the customer prior to scheduled delivery date and under cost.
- Meets: The contractor delivers products to the customer on scheduled delivery date and within cost.
- Fails: The contractor delivers products to the customer after scheduled delivery date and/or exceeds stated cost by more than ten percent.

5. SYSTEM AND APPLICATION DEVELOPMENT SERVICES

Project Title: Demonstration Capability Phase 1

LaRC Software Manager:

Software Software Control Class: Low

Responsibilities of Contractor and LaRC personnel: NASA will provide the contractor with access to the Cirrus aircraft and equipment, appropriate computer software licenses, and computer equipment located at Langley Research Center for development, integration, and test of all software developed in support of this TA. NASA will provide documentation and software of government furnished software and hardware. The availability of any Government-provided software and documentation will depend on release dates, rights in data, and may require non-disclosure agreements to be executed. NASA will provide information related to the development standards required for all development at NASA Langley Research Center. This information will include: -LMS-CP-5528 "Procedure for Software Planning", available on the LMS website -LMS-CP-5529 "Software Configuration Management Planning for Low-, High-, and Critical-Control Software", available on the LMS website -LMS-CP-0925 "Conducting Airborne Systems Laboratory Experiments", available on the LMS website -Documentation on the software standards for Simulation-to-Flight experiments.

Requirements:

1. Flight Software Minimum Requirements (Required for mission success in Phase 1)
 - a. The flight applications software shall interface with an operator and workstation

(keyboard, mouse, XGA 1024x768 display) in the right rear seat in the Cirrus SR22 aircraft. The software shall run under Windows 2000 in a General Purpose Computer (GPC) with a 3000 MHz Intel Pentium 4 processor, 2GB of RAM memory, a 40GB hard drive, Condor CEI-520-1608 ARINC 429 interface card, four RS-232 serial ports, and an NVIDIA dual channel graphics card.

b. The software shall also drive a second Avidyne EX-5000 multi-function display (MFD) on the main instrument panel. At a minimum, this VGA (800x600) display shall display UAS command and status information sent from the ground station. It is desirable that this display show additional information such as a moving map, current flight plan, and other aircraft traffic.

c. The flight software shall interface to two radio data links for redundancy via two RS-232 serial ports and the Ethernet port. The flight software will receive and process low rate time stamped commands sent from the Ground Station via redundant radio links, display the time and the commands on the Avidyne Display, re-format the commands into ARINC 429 words, send those commands to the Sandel SN3408 HIS and the S-Tec 55X Autopilot via the Condor 429 interface card, and send to the Ground Station a message acknowledging receipt of the uplinked command.

d. The flight software shall also interface to an Athena GS111m Air Data and Heading Reference System (ADAHRS) that will provide 50Hz data via RS-232 serial interface. The ADAHRS data listed in TABLE 1 includes airspeed, altitude, heading, GPS position, 3-axis accelerations, 3-axis rates, and 3-axis attitude. The flight software shall process this 50Hz data and send a sub-set of this data to the Ground Station via redundant radio links at a slower rate of 1 to 5 hertz. The Athena ADAHRS data subset is listed in TABLE 2.

2. Ground Station Software Minimum Requirements (Required for mission success in Phase 1)

a. The Ground Station software shall run in a General Purpose Computer similar to the one described above without the dual channel graphics card.

b. The Ground Station software shall also interface to a duplicate pair of the aircraft redundant radio data links via two RS-232 serial ports and the Ethernet port. All commands sent to the aircraft shall be sent via both radios in order to improve the

c. The Ground Station software shall provide the operator with a GUI for entering commands to be sent via the redundant data link radios to the aircraft. The initial phase of this project will only require a coarse or a heading (0 to 360) to be sent to the aircraft in integer degrees. The expanded capability of sending other commands such as speed, altitude, waypoint and flight plan data are anticipated for the future phases of this project.

d. The Ground Station software shall receive aircraft state data transmitted from the aircraft for display to the Ground Station Operator. The data will include a subset of the 50Hz Athena ADAHRS data defined in section 1d. This data can be displayed in a GUI panel with a box and label for each variable at a minimum. The preferred method of display would be a graphical Moving Map showing aircraft position and a Primary Flight Display showing aircraft attitude. The intention of this data display is to provide the Ground Station Operator and observers with the status, position, and state of the aircraft.

6. WORK-AREA SPECIFIC SERVICES

None required.

7. Exhibit A

None required.

8. SPECIAL SECURITY REQUIREMENTS

None

9. SOFTWARE ENGINEERING PROCESS REQUIREMENTS

None required.

10. JOINT REVIEW SCHEDULE

The Contractor and Task Monitor shall review project milestones and progress of deliverables at a minimum once a month.

11. PERIOD OF PERFORMANCE

This TA is effective from 04/01/08 to 04/27/09

12. TECHNICAL PERFORMANCE RATING

Quality is important, but delivery on schedule is also required for the success of this project.

Quality: 70% Timeliness: 30%

13. RESPONSE REQUIREMENTS

This Task Plan shall address the contractor's specific work plans, associated estimated labor hours, cost and schedule.

14. GOVERNMENT ESTIMATED COST

15. FUNDING INFORMATION

Funding last submitted on 05/08/2008.

16. MILESTONES

None required.

17. DELIVERABLES

Number	Deliverable Item	Deliverable Schedule
1	UAS SURROGATE RESEARCH AIRCRAFT SOFTWARE	as required through 4/27/2009

18. FILE ATTACHMENTS

None.